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field crops

PROJECT BOOK

CANADIANA
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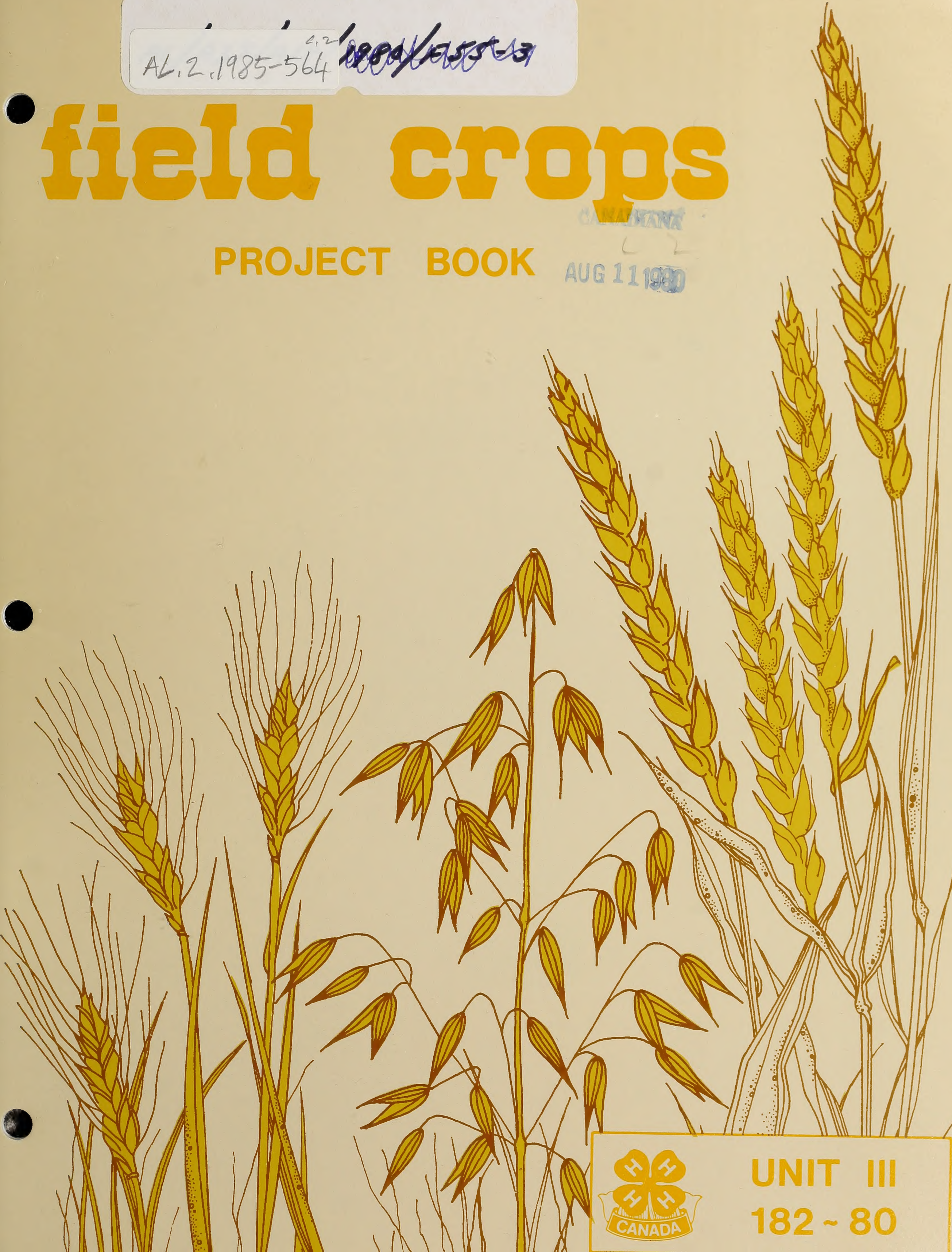

CANADA

UNIT III
182 ~ 80

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4-H MOTTO

"Learn to do by doing"

4-H PLEDGE

I pledge
My HEAD to clearer thinking,
My HEART to greater loyalty,
My HANDS to larger service,
My HEALTH to better living,
For my club, my community and my country

4-H GRACE

(Tune of Auld Lang Syne)

We thank thee, Lord, for blessings great
On this, our own fair land.
Teach us to serve thee joyfully,
With head, heart, health and hand.

UNIT III - WINTER PROJECTS & REFERENCES

CONTENTS

I SOIL
  A. What is Soil?
  B. Soil Nutrients and Fertilizers
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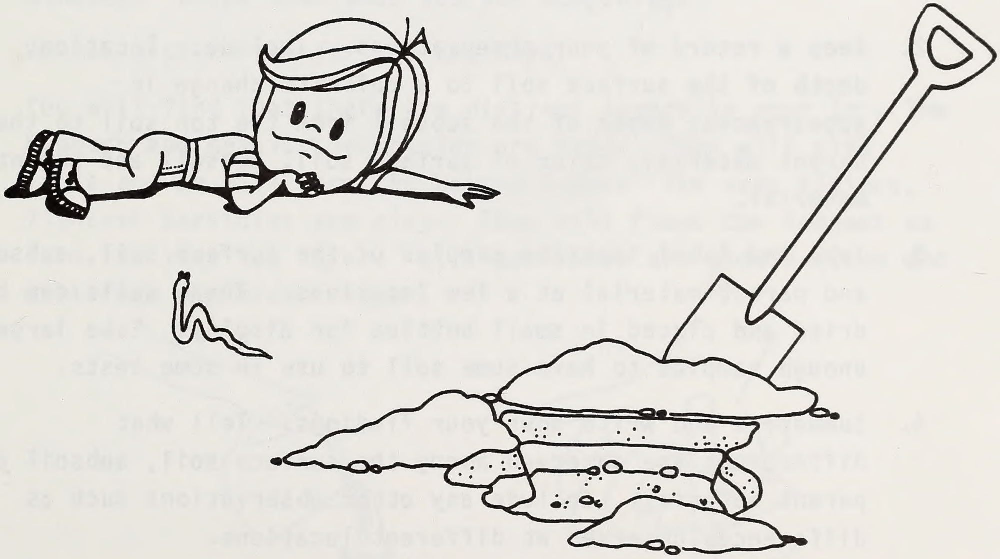
SOIL

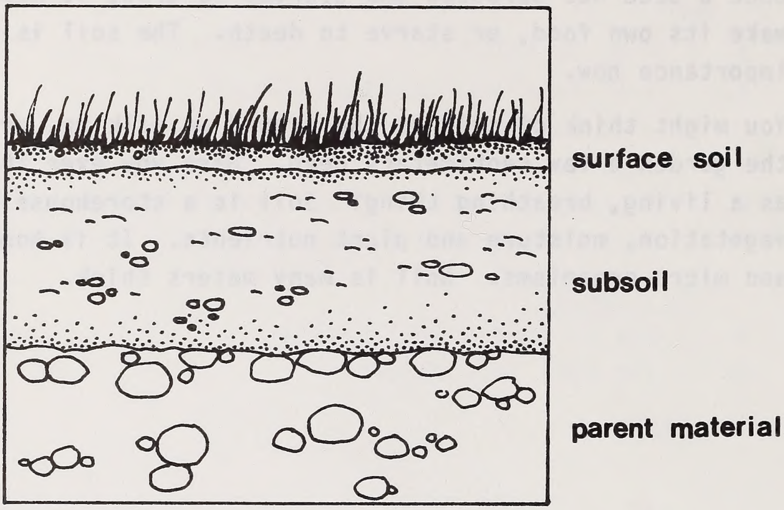
Once a seed has sprouted and started to grow, it must start to make its own food, or starve to death. The soil is of great importance now.

You might think of soil as the ground we walk on, or the dirt in the garden a few centimeters deep. Have you ever thought of soil as a living, breathing thing? Soil is a storehouse of decaying vegetation, moisture and plant nutrients. It is home for insects and micro-organisms. Soil is many meters thick.



A. WHAT IS SOIL?

1. Look at the banks of road cuts, excavations, and other places where soil depth is exposed.



2. Keep a record of your observations. Include: location, depth of the surface soil to a definite change in appearances; depth of the subsoil from the top soil to the parent material; color of surface soil, subsoil and parent material.

3. Take and label separate samples of the surface soil, subsoil and parent material at a few locations. These soils can be dried and placed in small bottles for display. Take large enough samples to have some soil to use in some tests.

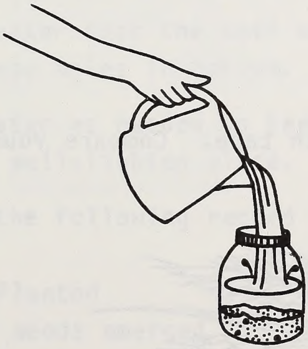
4. Summarize and write down your findings. Tell what differences you observed among the surface soil, subsoil and parent material. Include any other observations such as differences observed at different locations.

5. The cross section of an area of soil is called a SOIL PROFILE.

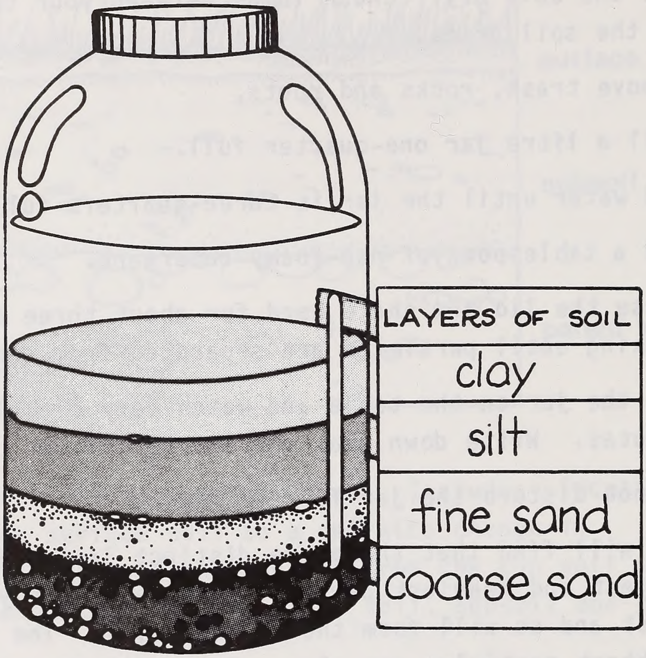
Soil is made up of different types of particles. Every soil is slightly different because it has various amounts of different types of particles.

PROVE IT TO YOURSELF

1. Get a litre of soil from the garden, flower bed or field.
2. Let the soil dry. Crush lumps between your thumb and finger as the soil dries.
3. Remove trash, rocks and roots.
4. Fill a litre jar one-quarter full.
5. Add water until the jar is three-quarters full.
6. Add a tablespoon of non-foamy detergent.
7. Close the lid and shake hard for about three minutes. Keep shaking until particles are separated from each other.
8. Set the jar on the table and watch very closely for a few minutes. Write down what you see happening.
9. Do not disturb the jar for two days.
10. You will find that there are distinct layers in your jar. The biggest and heaviest particles are sand. They will sink first and so will form the bottom layer. The very tiniest, lightest particles are clay. They will float the longest so form the very top layer. Silt particles are middle-sized and will form the middle layer.



Place a card alongside the jar. Mark off the depth of the clay, silt, sand and coarse sand. Label your card for each layer.



11. Fasten the card to the jar with tape. Compare your soil with other members'.

Soil is made from parent material (rock) by heat, cold, water and wind. These processes are called WEATHERING. As you come closer to the parent material the soil is less able to support growth.

PROVE IT TO YOURSELF

1. Use a litre of surface soil and a litre of subsoil collected when studying the soil profile.
2. Select four containers, such as the bottoms of cut-off milk cartons, tin cans or flower pots. Punch holes in bottoms for drainage.
3. Label two containers "subsoil" and fill with finely crushed subsoil.
4. Label two other containers "surface soil" and fill with finely crushed surface soil.
5. Select corn, beans or other similar seeds.
6. Plant four seeds in each container, about three cm deep.
7. Pour water over the soil until it begins running from drainage holes in bottom.
8. Add water as needed to keep the surfaces moist. Keep in a warm, well-lighted place.
9. Keep the following record for two months:

	SURFACE SOIL	SUBSOIL
Date Planted		
Dates seeds emerged		
No. of days to germinate		
How many seeds came up?		
Did the plants stay green?		

Was there a difference in the number of seeds germinating in the two soils?

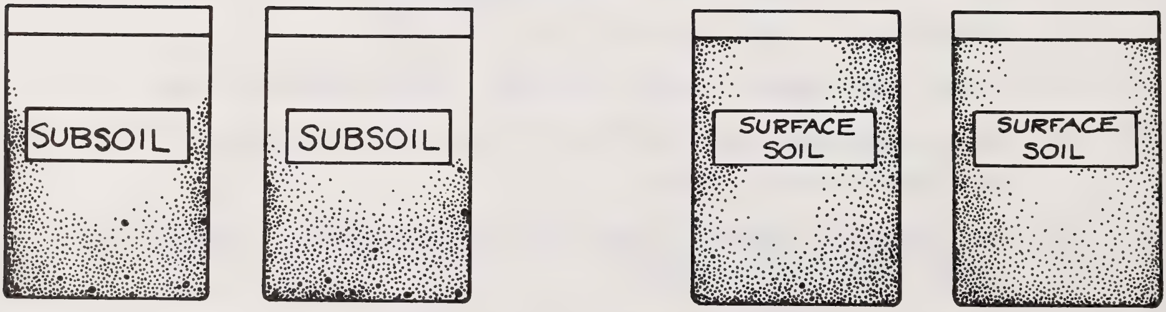
If so, how do you account for this?

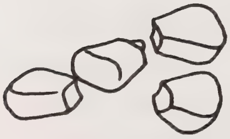
Was there any difference in the color or vigor of plants in the surface soil and subsoil?

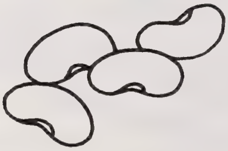
If so, write down the difference with any explanation you have for this difference:

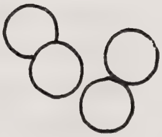
When wind and water erode the land what kind of soil do they remove?

Will erosion affect yield?




corn

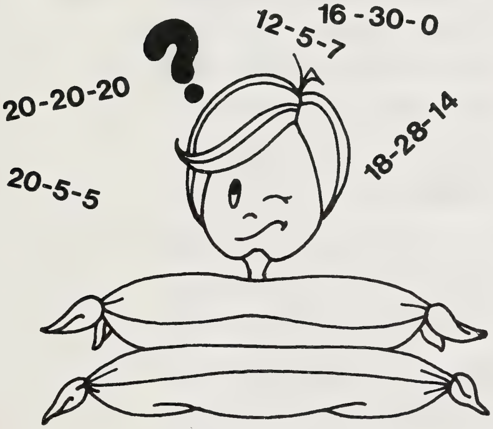

beans


peas

B. SOIL NUTRIENTS AND FERTILIZERS

Within the soil particles are various nutrients. The most important of these are nitrogen (called N for short), phosphorus (P), and potash (K). The nitrogen promotes lush growth and dark green color. The phosphorus promotes root growth, flower and seed development and early maturity. Potash (potassium) has a balancing effect, promotes strong stems, good root systems and resistance to diseases.

As plants grow on the soil they deplete the supply of N, P and K. Unless the land is allowed to rest so that micro-organisms can produce a fresh supply, or unless fertilizer is added, plants will begin to suffer from lack of food.



Fertilizers are named according to the amount of nitrogen, phosphate, and potash they contain. The first number is the percentage of the mixture that is nitrogen (N), the second number is the percentage of the mixture that is phosphate (P_2O_5), and the third number is the percentage of potash (K_2O). 16-20-0 has 16% nitrogen, 20% phosphate and no potash.

20-5-5 has what % nitrogen: ____ phosphate?____ potash?____
20-20-20 has what % nitrogen: ____ phosphate?____ potash?____
20-30-20 has what % nitrogen: ____ phosphate?____ potash?____

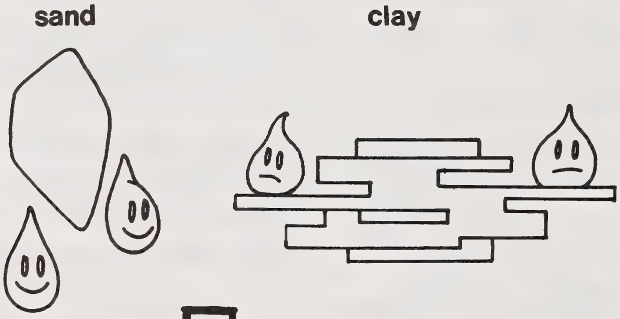
If all these were the same price and your soil needed phosphorus, which would you buy? ______________________________

C. SOIL WATER CAPACITY

Although bits of soil seem to fit together tightly, there are spaces between them. These spaces are filled with air or with water. If all the spaces are filled with air the plants will die of "drought". Plants need both air and water in the soil to grow well.

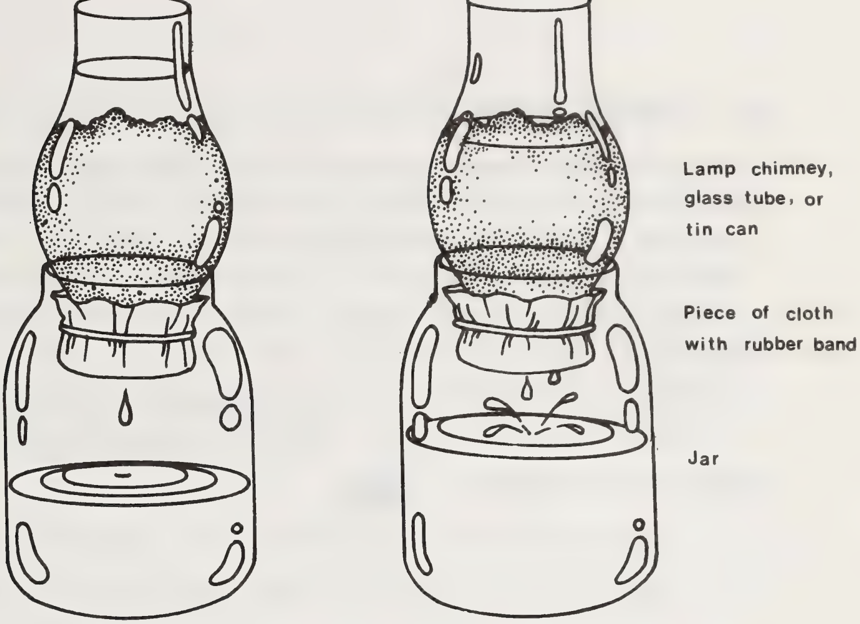
If drainage is good there is usually no problem with having too much water in the soil. The excess will run away into underground water sources deep in the earth. Sufficient water is retained in the soil by physical forces.

Different types of soils will hold different amounts of water. A sand grain is very smooth and doesn't hold water very well. Clay particles are built like stacks of coins. There are lots of nooks and crannies to hold water. The amount of water a soil will hold depends on the amount of sand and clay and the drainage.



PROVE IT TO YOURSELF

1. Select two or more soils that differ in color or texture. Try to get a sandy soil and clay or silty soil.
2. Fasten a piece of cloth, such as from an old shirt, over the ends of large glass tubes or lamp chimneys with a string or rubber band. Drink cans with both ends removed will also work. Drink cans with one end removed and holes punched in the remaining end are satisfactory. Fit a piece of a cloth or paper towel over the holes so the soil won't plug them.


Lamp chimney, glass tube, or tin can
Piece of cloth with rubber band
Jar

3. Fill the containers with equal amounts of the different soils.

4. Place them as illustrated over mayonnaise, peanut butter or other jars of equal size.

5. Add equal amounts of water to each container - about one-half the volume of the soil. Avoid pouring water into the jar below.

6. Note the rate that water is added and the time when water stops coming out of the bottom of the tube. This time interval indicates the rate that water moved through the soil (permeability or filtration rate).

7.

	CLAY	SAND
How long between time when water added and water begins coming through the soil?	________	________
How long after you added the water did water stop coming from the soil?	________	________

How can you change a soil's ability to hold water?

D. ORGANIC MATTER

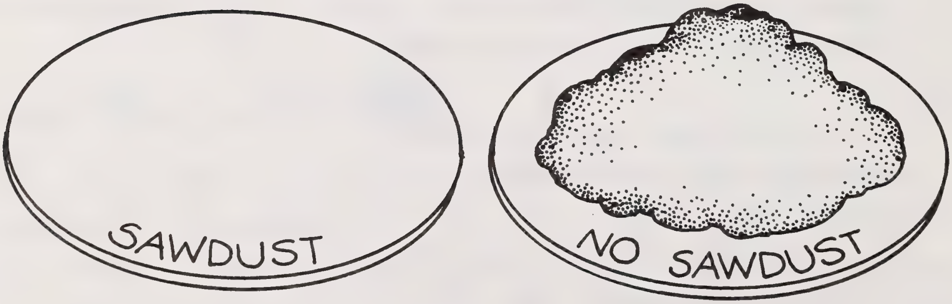
You know that there is more to soil than sand, silt and clay. You have probably noticed the decaying plant material in your samples. There are also plant roots, worms and insects and very small microscopic bacteria. These organisms are responsible for eating (decaying) the organic matter and freeing nutrients into the soil. Special bacteria which can only grow on the roots of legumes (such as clover, beans and peas) can actually take nitrogen from the air and add it to the soil.

PROVE IT TO YOURSELF

1. Collect a litre of clay soil and a litre of sawdust.
2. Label a paper plate "sawdust" and another "no sawdust".

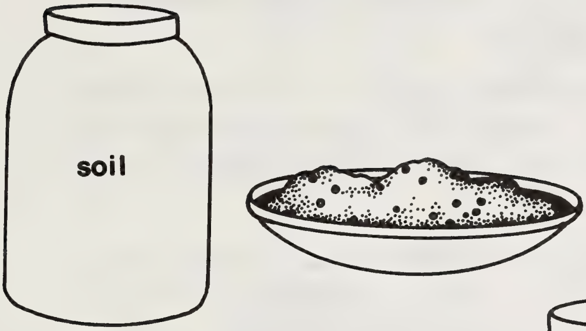
3 Moisten 250 ml of soil until you can form a mud cake. (If the soil does not hold together, get a soil with more clay.)

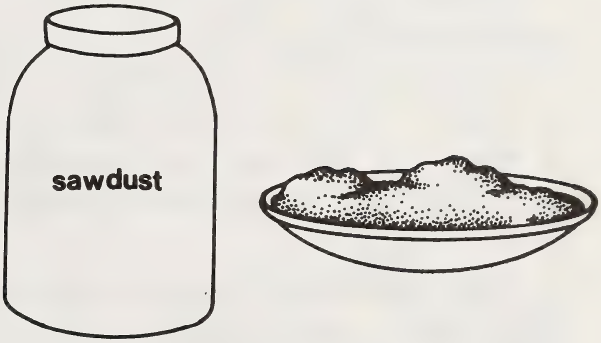
4. Place the mud cake on the plate labeled "no sawdust".
5. Moisten and mix thoroughly 125 ml of soil and about 60 ml of sawdust until they form a mud cake.



6. Place the mud cake on the plate labeled "sawdust".

7. Place both plates in the sun and let the mud cakes dry.





8. Record your observation when they are completely dry. Break the mud cakes with your hands.
Which cake crumbled easier? ______________________________
How would you explain this? ______________________________
____

9. How can you improve the physical condition of the soil on your farm? ______________________________
____
____
____

E. FACTORS THAT AFFECT THE TYPE OF SOIL DEVELOPMENT

There are many types of soil identified and mapped out in Alberta. Each type has its own special characteristics. They are all different because they are all formed under different conditions.

CLIMATE - Some soils are formed where there is a lot of rain and a generally cool temperature. Others are formed where there is no rain and very hot temperatures. As you would suspect, these soils are very different.

VEGETATION - Most of the soil on the prairies was formed under grass. Grass produces many small rootlets which die and decay. Soil formed under grass is very black, full of organic matter, fertile and with good texture. Some of the soil is formed under trees. The soil does not contain as many roots, and any organic matter is from decaying leaves and needles and tends to remain in a separate layer on top of the soil. These soils are very different.

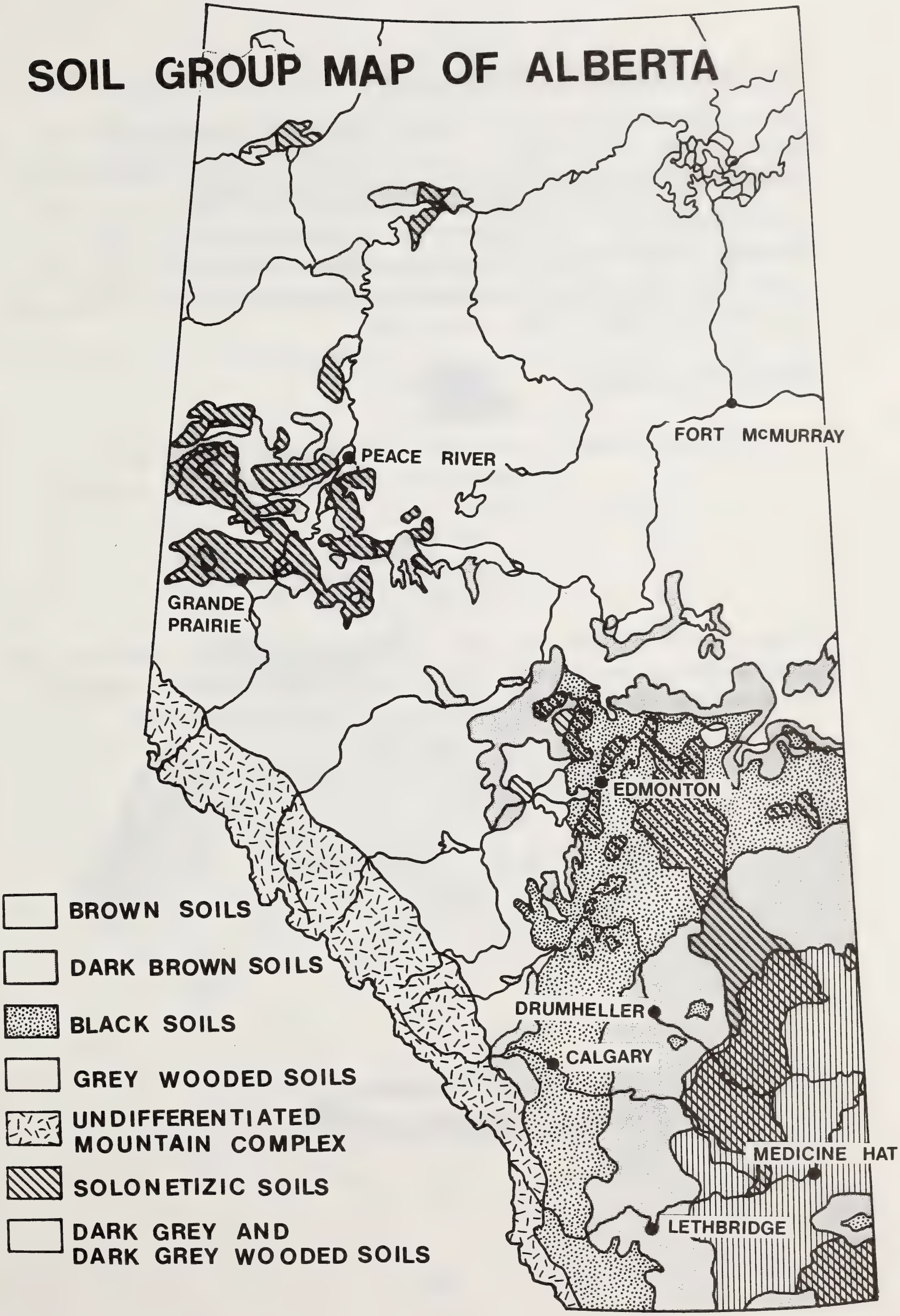
PARENT MATERIAL - The rock layer found underneath the soil is called the parent material. This is because this was the parent or origin of many of the soil particles. Also, the layer of rock still influences the soil by controlling how quickly the water can run off, and other factors.

THE SHAPE OF THE LAND - The shape of the land is called relief. It controls the drainage of an area - and this affects the soil type.

Soil scientists work very hard producing very detailed maps of all the soil in the province. These maps tell about the type of soil in an area, the climate of an area, the classification of the land, statistics of agriculture in an area and facts about water drainage.

Your club should have a copy of the local soil map. If not, the maps are available from the nearest Alberta Department of Agriculture Office.

SOIL GROUP MAP OF ALBERTA



F. SOIL EROSION AND CONSERVATION

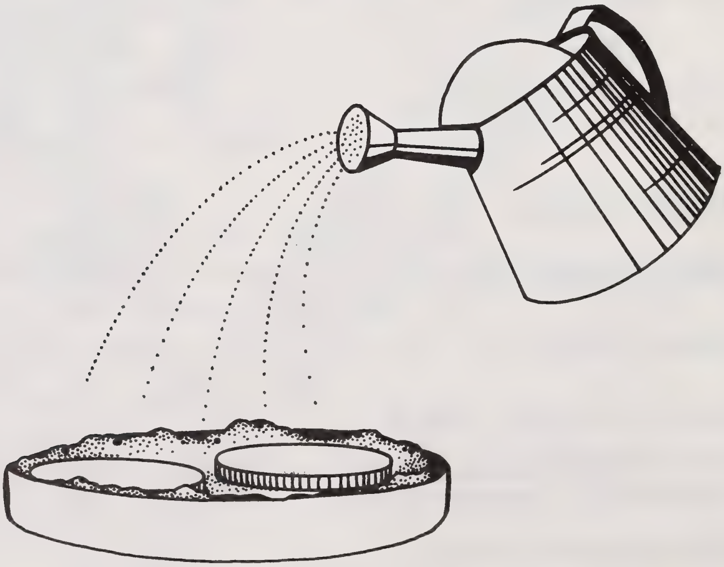
Soil erosion is the wearing away of soil particles by wind and water. Some erosion occurs naturally under all conditions but it becomes a more serious problem on cultivated land.

Wind erosion can often be detected by seeing clouds of dust blowing across fields and by noticing the build-up of soil drift along fence lines and shelterbelts. Rain also causes erosion and is easier to copy in test conditions.

PROVE IT TO YOURSELF

You will need:
- some soil (preferably a sandy soil - sandy soils are more prone to erosion);
- an old jar lid;
- a cake pan;
- some large coins;
- a sprinkling can.

Place the lid filled with soil inside the cake pan. Place two or three coins on top of the soil. Hold the sprinkler can about 30 cm above the soil and sprinkle the soil to simulate rain.



What happened? ____

____

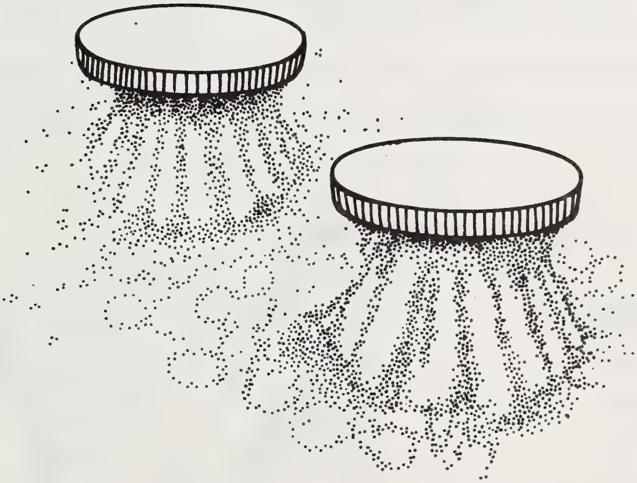
____

Did this show you that raindrops can cause erosion? ____________

____

Do you see the importance of soil cover? ____________________

____

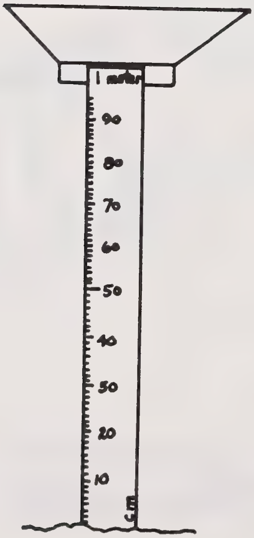


PROVE IT TO YOURSELF

Different ground covers have different effects on erosion. Detachment of soil particles from the soil surface is the beginning of erosion. You can measure this on a splash board. You will need at least three splash boards.

TO MAKE A SPLASH BOARD:

1. Find a board one meter high, three cm thick and at least 10 cm wide.
2. Sharpen one end (so that it can be pounded into the ground).
3. Paint the board white.
4. Nail another board (10 cm X 20 cm) to the top so that raindrops do not wash off the splash marks.
5. Once the splash board is pounded into the ground, mark lines across, starting at ground level and at every 20 cms all the way to the top.



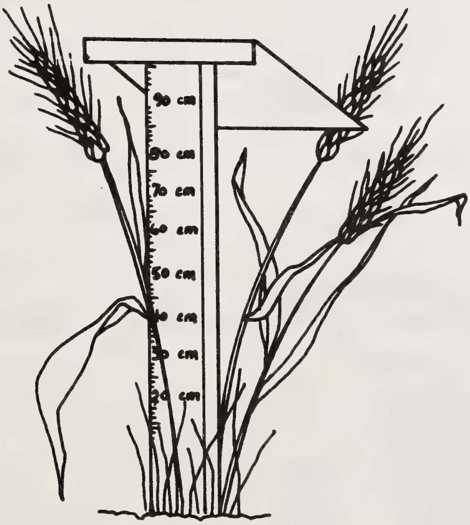
Place a splash board on different types of ground. One should go on recently worked bare soil, one on dense sod and one in a cropped field. You might wish to test other places.

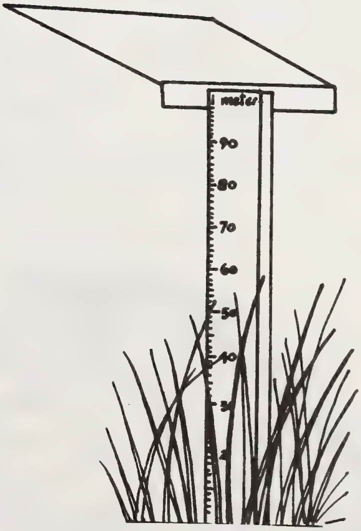
Observe the boards after several rains, record the results and clean them off each time. You might like to photograph the results.

Record the height to which splash marks were visible:

	1ST RAIN	2ND RAIN	3RD RAIN
Bare ground			
Sod			
Cropped field			

What did you learn from this exercise?



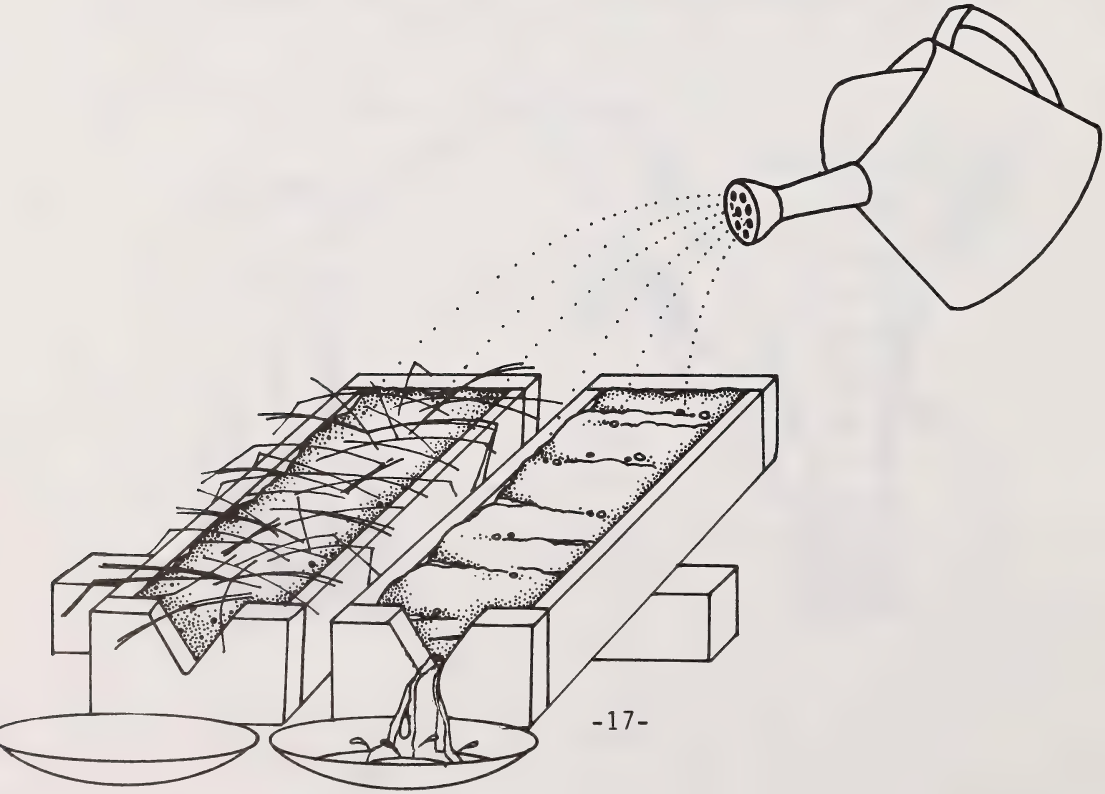


SOIL CONSERVATION

Good land management is needed to prevent soil erosion. You should always have some kind of mulch or trash cover over the land.

PROVE IT TO YOURSELF

1. Find two long shallow boxes about 40 cm long, 30 cm wide and 10 cm deep. Line with plastic to make them watertight. In one end of each box, cut a V-notch 5 cm deep.
2. Fill the boxes with the same kind of soil. Cover one box with a layer of grass clippings or straw. Tilt the boxes slightly by setting the unnotched side on a small stick (3 cm high).
3. Let the notched edge hang over the table edge with jars or pails placed on stools to catch the run-off.
4. Sprinkle water slowly on each box. Be sure to apply the same amount of water, from the same height on each box.



What happened? ____

____

Which box lost the most soil? ______________________________
Why? ____

____

____

From which box did the water stop flowing first? __________
Why? ____

____

Which box lost more water? _________________________________
Why? ____

You might want to try the same test using different mulch materials, sod and bare soil, contoured or furrowed, non-furrowed soil, etc. Write up the results of these tests here:

____

____

____

____

____

____

____

____

____

____

____

SOIL SAMPLES

What soil analysis can do:

1. Measure a) Available nutrients in soil.
   b) Kinds and amounts of soluble salts.
   c) Acidity or alkalinity of soil (soil ph).
2. Make recommendations for improvement of your soil.
3. Give an indication of organic matter content and the soil texture.

A. HOW TO TAKE A SOIL SAMPLE

Proper collection of soil samples is extremely important as tests can only be as accurate as the sample.

1. Size up the area - observe variations in texture, color, slope, drainage, yields, past fertilizing, manuring or cropping.

2. Avoid such areas as back furrows, stack bottoms, waterways, alkali spots, etc., or sample and label them separately.

3. Using a soil auger, gardening trowel or spade, take 15-20 individual samples to a depth of 15 cm, from various spots over the field or area to be tested. Combine these, mixing them thoroughly.

4. Air dry the composite sample before mailing it by spreading it thinly on clean paper. Do not dry with heat. If it is not dried properly, the results of the nitrogen test will be too high.

5. Place a plastic bag inside a cardboard box and completely fill the bag with the soil mixture; tie the bag securely. Label with your name, address and the number of the sample corresponding to the field sample number on the information sheet. (Plastic bags, boxes and information sheets can be obtained from your District Agriculturalist.)
6. Provide complete information as called for on the information sheet and mail it with the required fee to the Agricultural Soil and Feed Testing Laboratory, O.S. Longman Bldg., 6909 - 116 St, Edmonton, Alta. T6H 4P2.

B. THE SOIL TEST REPORT

What the Report will tell you...

1. The recommendations for fertilizers to be added which are given in Units of Nitrogen (N), Phosphate (P_2O_5), Potash (K_2O) and Sulphur (S).

2. Available nutrients in the soil--which are given in Units of Nitrogen (N), Phosphorus (P), Potassium (K), and Sulphur (S).

3. The soil ph or the acidity or alkalinity of the soil. Ph is a scale. A ph of 7 is neutral. As the ph decreases below 7, the soil becomes more acid. As the ph increases above 7, the soil becomes more alkaline.

NOTE: Most plants grow best in soils that are near-neutral, ph range of 6 - 8. In soils with a ph of less than 6, legumes cannot fix nitrogen. In soils with a ph of less than 5.5 may contain large amounts of soluble Aluminum (Al) and Manganese (Mn), which are toxic to many plants. Plants vary greatly in their sensitivity to Al or Mn toxicity: oats are fairly tolerent to both, barley is very sensitive to Al and rapeseed is fairly sensitive to both Al and Mn toxicity.

4. The kinds and amounts of soluble salts. A saline soil is one which contains sufficient water soluble salts to impair its productivity. The commonest soluble ions in western Canada saline soils are sodium (Na+) and sulphate (SO_4=).

The concentration of these soluble salts are reported as either low (L), medium (M) or high (H). A high concentration of N_2+ is associated with hardpan soil conditions, commonly referred to as "gumbo".

Most plants are adversely affected by high soluble salt concentrations. Some are more tolerant than others. Barley is more tolerant than wheat or oats. Generally, saline soils are also alkaline soils or soils with a ph greater than 7.

5. The Report will also give you some indication of organic matter content and the texture (amounts of sand, silt and clay) of the soil.

Your local district agriculturalist will be glad to help you interpret your soil test report.

SOURCES

1. Anonymous, 4-H Field Crops Manual, Manitoba Department of Agriculture.

For further information on any of these topics, see your local Alberta Agriculture Office, or talk to your local D.A. He or she has publications and information on almost any agricultural topic.

Special thanks to 4-H Regional Specialists Brian Matthiessen (Red Deer) and Milo Barffus (Lethbridge) for co-operating with the development of this Field Crop Series.

PROJECT EVALUATION

In order to keep meeting your needs in the 4-H program, we would like to request your assistance in completing this evaluation form. Make your suggestions on this sheet as you use this book. After the project has been completed, mail this form to:

Project Evaluation
4-H Branch
Alberta Agriculture
9718 - 107 Street
Edmonton, Alberta
T5K 2C8

(use another page if required)

N.L.C. - B.N.C.
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